Nitrogen and Sulfur Oxides

Background

Nitrogen oxides (NOx) consist of nitric oxide (NO), nitrogen dioxide (NO2) and nitrous oxide (N2O) and are formed when nitrogen combines with oxygen. Nitrous oxide is naturally present in the atmosphere as part of the Earth's nitrogen cycle, and has a variety of natural sources. The nitrogen cycle is the natural circulation of nitrogen among the atmosphere, plants, animals, and microorganisms that live in soil and water. Natural emissions of N2O are mainly from bacteria breaking down nitrogen in soils and the oceans. Nitrous oxide is removed from the atmosphere when it is absorbed by certain types of bacteria or via chemical reactions. However, human activities such as agriculture, fossil fuel combustion, wastewater management, and industrial processes are increasing the amount of N2O in the atmosphere.

Sulphur dioxide (SO2) is formed when sulphur combines with oxygen in the air, usually under high temperatures. In nature, volcanic eruptions can release sulfur dioxide into the air. SO2 is a product of fuel combustion, the burning of coal and oil that contains sulfur, primarily emitted from power plants.

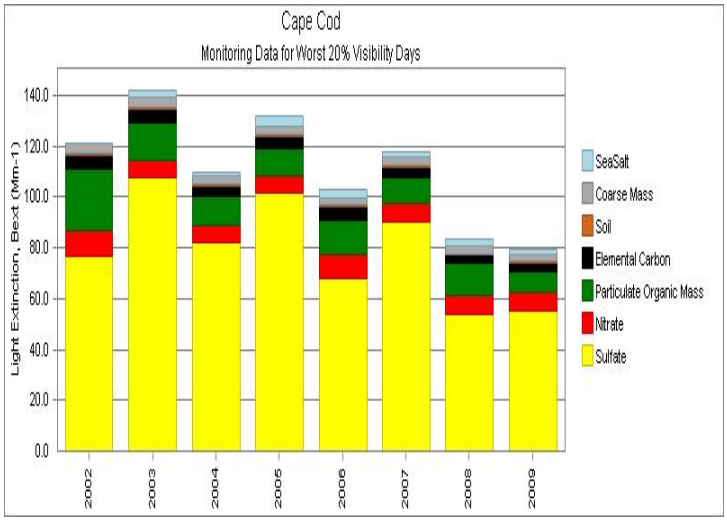

Figure 1. IMPROVE aerosol data collected annually from 2002-2009 indicate that sulfate in the atmosphere has had the greatest contribution to the diminution of visibility at CACO.

Additionally, sulfur dioxide may combine with ozone to cause a severe needle tip burn in some of the CACO's conifer populations. According to the EPA, sulfate particles account for 50 to 70 percent of the visibility reduction in the eastern part of the U.S., severely affecting a visitor's enjoyment of national parks.

Long-term Monitoring

Nitrogen and sulphur oxides have similar, negative health and environmental effects. In regards to human health, both lower resistance to respiratory infections and aggravate symptoms associated with asthma and bronchitis. Environmentally, both contribute largely to acid deposition, which in turn contributes to the acidification of lakes and streams, damage to vegetation, and atmospheric haze and decreased visibility. The risk of surface water acidification is considered high in CACO's poorly buffered ponds and vernal pools.

Management Applications

Information on nitrogen and sulphur deposition, is important to regulators, policymakers, and land managers responsible for the protection of air and water quality in natural and managed ecosystems.

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